BIOMETRIC AND TAXONOMIC USES OF CELLULOSE ACETATE PLASTIC

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Plastics have been used in botany as embedding media and as films, sheets, or bags to hold or cover specimens. The present paper discusses one particular kind of plastic, cellulose acetate, and its versatility and usefulness in taxonomy.

The late Prof. N. C. Fassett described (1951, pp. 141-2) his method of mounting small seeds of species of *Callitriche* on transparent 1″ by 1½″ cellulose acetate slides. These mounts were easy to handle, permanent, and storable in the envelopes attached to herbarium sheets. To attach seeds to slides Fassett used acetone in which pieces of the cellulose acetate plastic were dissolved. This quick-drying solution also was used to reattach plants to herbarium sheets. Slides were labelled with india ink. Fassett (1949) used slender slivers of the plastic as aids in picking up seeds and other tiny objects by static electricity.

The most valuable characteristic of the plastic is its transparency. Inscriptions made on its surface or plant parts mounted on it may be superimposed on plant material, permitting a side-by-side comparison through a dissecting microscope or hand lens. Two other characteristics of the plastic are also important: it may be cut in any size or shape with a paper cutter or shears; its surface may be easily inscribed with lines, numerals, or other markings. Conventional glass slides do not have the latter advantages.

Plastic slides prepared in 1961 appear permanent. Clear nail lacquer ("fingernail polish") was used as a glue — it is inexpensive, quick-setting, and has its own applicator brush. Slides (Fig. 1) have been made in two sizes: 3″ by 1″ for storage in standard microscope slide boxes; and 6¼″ by 1″ for storage in double-rowed wooden slide boxes by removing the wooden center partition. The longer slides are more useful for holding long, narrow plant parts, e.g., grass spikes, leaves, or portions of stems. Both sizes

Plate 1399.

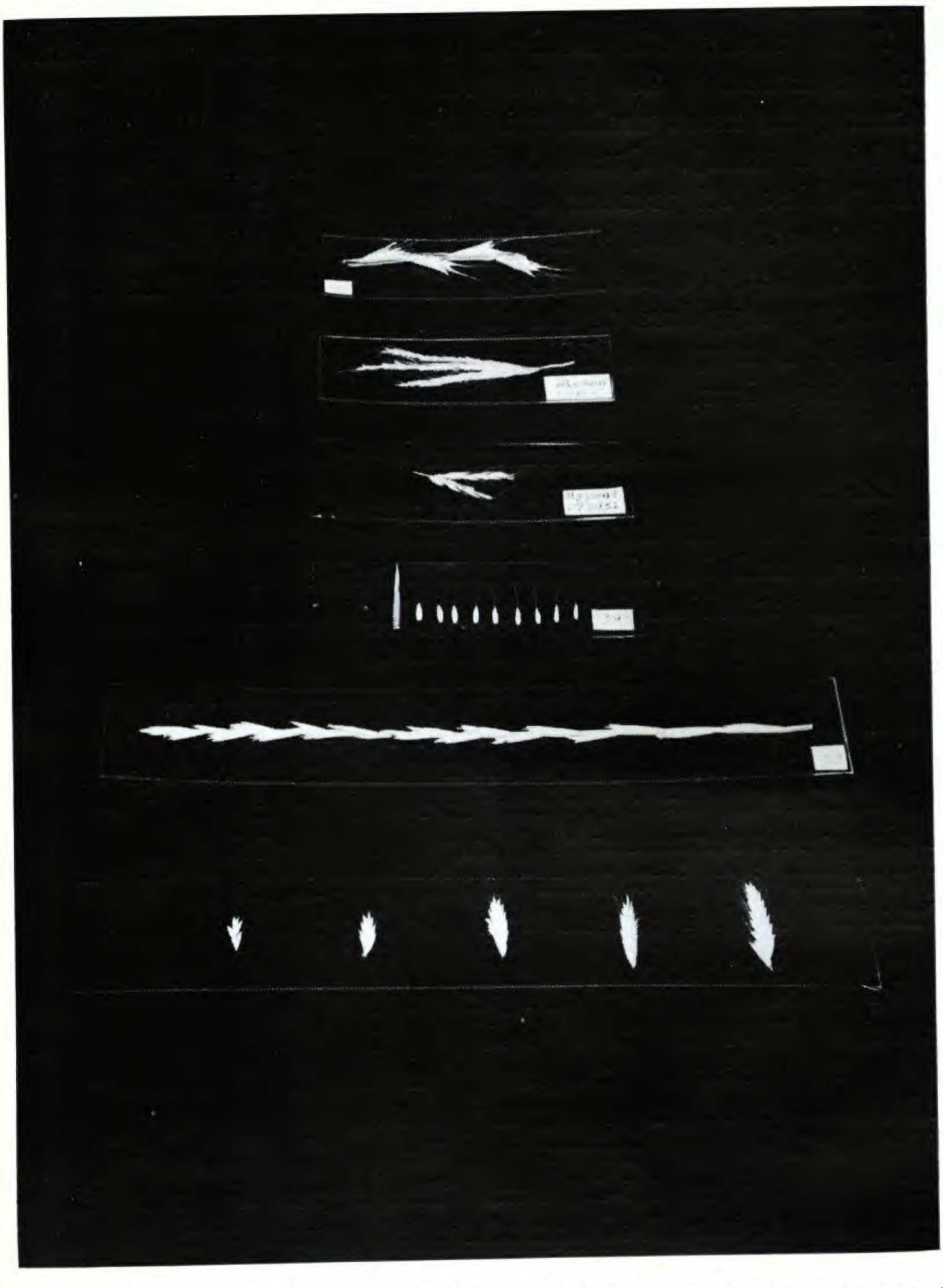

Fig. 1. Plastic slides (3″ × 1″ and 6¼″ × 1″) bearing mounted plant material.

of slides are particularly well-suited for taxonomic studies of grasses and other plants with small reproductive parts.

Transparent cellulose acetate with polished surfaces may be purchased in 20″ by 50″ sheets of various thicknesses. Among the most useful thicknesses are .020″ (0.5 mm.) to .040″ (1 mm.). Commercial "see-thru" rulers are about .020″ thick. At present, the retail costs per sheet are about $4.50 for .040″ and about $2.70 for .020″. Over 300 3″ by 1″ slides may be cut from one of these sheets. There are at least two suppliers of the plastic in the Washington, D. C. area; it is supposed that any large city would have one or more suppliers.

Measurement of Variation

Cellulose acetate is useful in making the measurements needed for the study of hybridization by Andersonian methods and in other kinds of biometrical and numerical taxonomic studies. Three general kinds of uses are possible: (1) slides or pieces of plastic marked with lines, angles, etc. as measuring devices, (2) plant material mounted on plastic for visual comparison, (3) plastic cut into the shape of leaves or other parts after tracing an outline of the part. The first two procedures speed up the mechanics of making measurements and improve objectivity. The third procedure has not been tested, but might be useful if "model" leaves representing typical or other states of variation were needed.

In an investigation of hybridization between two grass species (Terrell, Hovin, and Hill 1965), a plastic device (Fig. 2) was used to measure glume length. The total range of variation in glume length was first established and then divided into class-groups as follows: 1.5-1.9 mm; 2.0-2.4 mm; etc. up to 5.5-5.9 mm. The *upper limits* of class-groups were inscribed on a slide: 1.9 mm; 2.4 mm; 2.9 mm; etc. up to 5.9 mm (such inscriptions rubbed with a red pencil are more easily visible). By overlaying the slide on the samples to be measured the lengths of the glumes were determined as far as the class-groups were concerned. In measuring the samples only "yes-or-no" decisions were

Plate 1400.

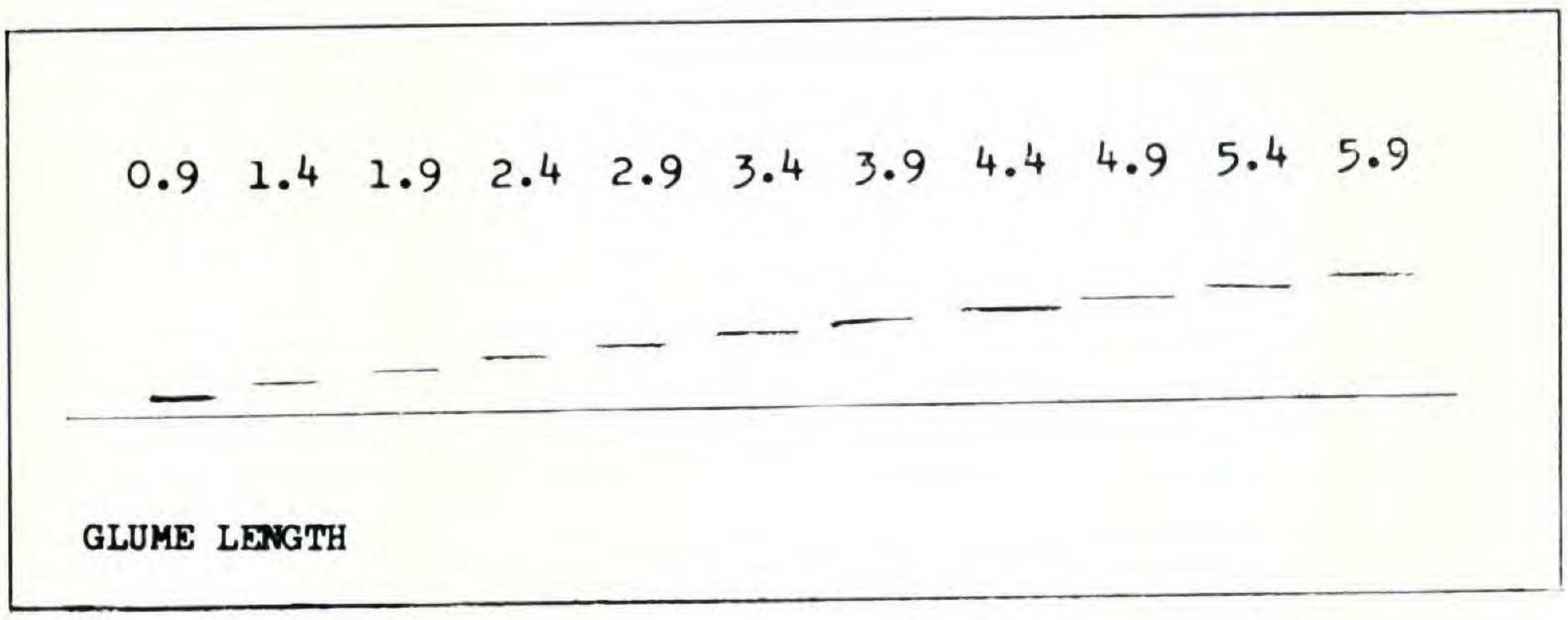

Fig. 2. Plastic device used in measuring length of glumes (see text).

required: if glume lengths in plant 3657-1 were longer than 1.9 mm but shorter than 2.4 mm they fell into the "2.4 group". (The number, 2.4, was circled on a mimeographed sheet previously set up for recording data.) For statistical purposes all glume lengths in the "2.4 group" were assumed to be at the mid-point of this class-group, namely 2.2 mm. This mid-point convention is believed statistically valid, especially in view of the small sizes of the class-groups. By using this convention, graphical and statistical treatments were simplified. However, the important point is that the slide as prepared above permitted faster measuring. Parenthetically, it may be pointed out that the slide actually used could have been inscribed like a ruler but only with class-group lines.

One of the ways in which plastic slides are most useful is in measuring such difficult-to-measure characteristics as density of hairs. Two conventional ways to measure density would be to: (1) use a plastic ruler and count the number of hairs per linear unit; or (2) cut a hole in a piece of

paper, overlay on the samples, and count the number of hairs per unit area. On the other hand, one may mount the actual plant material on plastic slides. As a preliminary, the total range of density present in the plant material studied is divided into equal-sized class-groups. The plants are surveyed to find plant parts with hair densities representing the upper limits of class-groups. Pieces of stem or other plant parts representing the desired states of density are cut and mounted on a plastic slide. Each piece is given a code number for recording of data. Measuring of the samples involves only "yes-or-no" judgments, made instantaneously by visual comparison. Preparation of the completed slide takes longer; but, once prepared, the slide permits faster measurements by eliminating the counting part of the operation, only matching is involved.

There are other difficult-to-define characteristics. It is not easy to put into words or numerical terms degrees of variation in texture of hairs, appression of hairs, or induration of glumes, for example. If the actual plant parts are mounted on plastic, verbal descriptions such as hirsute are defined in terms of the hairs themselves. Once the initial decision is made as to what will be meant by hirsute, the plant part mounted on the plastic becomes a model or standard for all subsequent comparisons. The standard never changes and does not have to be remembered, only preserved. Samples to be measured are judged by visual matching with the objective standards, not with vague concepts held in the mind.

Herbarium and Reference Uses

Slides. Slides bearing mounted plant parts are useful also to the monographer studying a plant group or to the person who wishes to have available a representative critical part of a species as an identification-aid. Two of the slides in Fig. 1 were prepared for the latter purpose; they bear typical inflorescences of *Hyparrhenia rufa* and *Dichanthium annulatum*, introduced grass species. They were labelled with six letters, the first three letters of the genus and species names (e.g., Dicann=*Dichanthium annulatum*). A

Plate 1401.

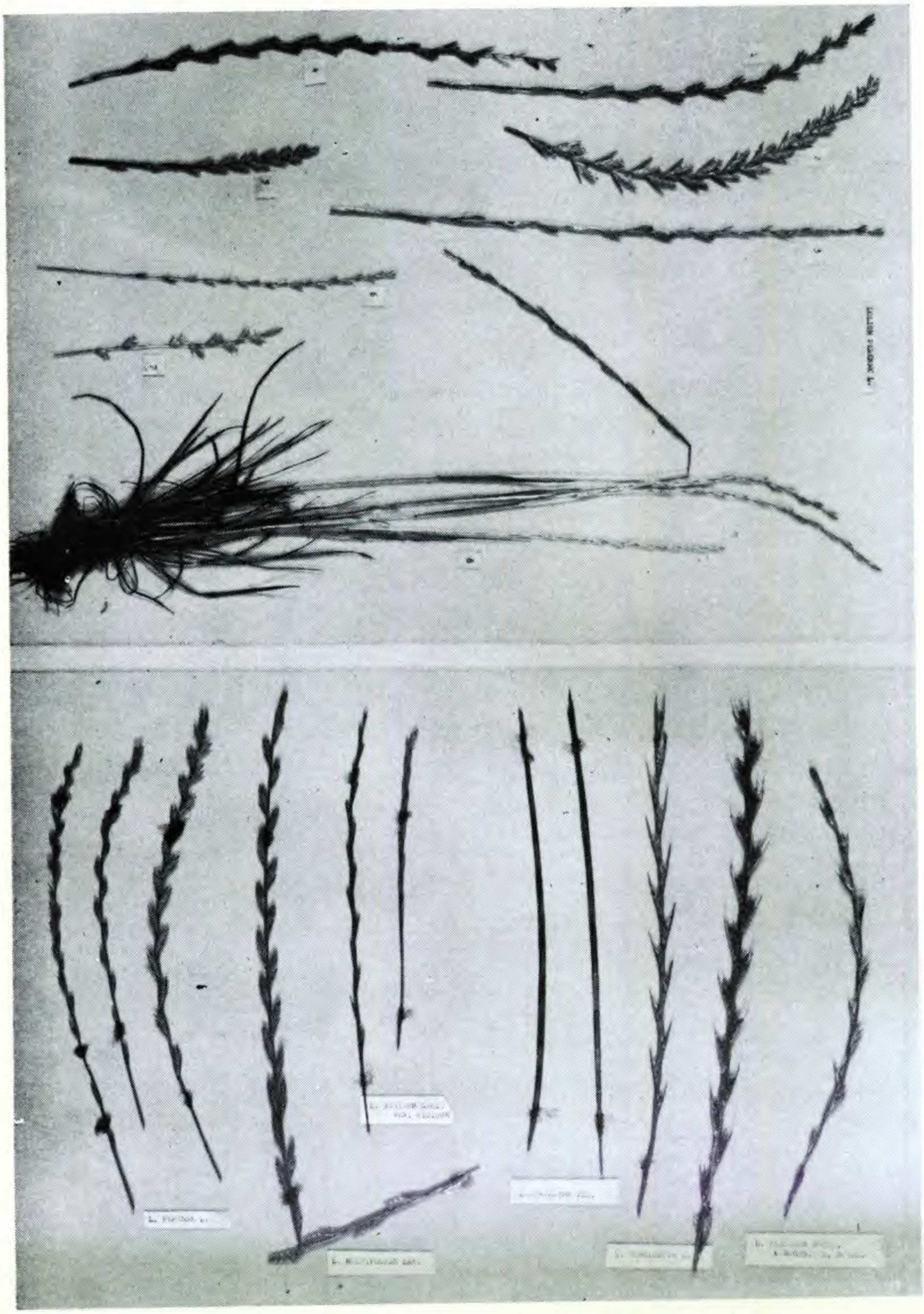

Fig. 3. (above). Plastic herbarium sheet bearing *Lolium perenne* plant and spikes. Fig. 4. (below). Sheet bearing spikes of six *Lolium* species.

number followed, in this case U.S.D.A. PI numbers for specimens from which the inflorescences were obtained. Written records of the source data were kept for each slide.

Herbarium sheets. A plastic sheet 20″ x 50″ may be cut into four standard-sized (11½″ × 16½″) herbarium sheets (with some plastic left over for slides). When used as herbarium sheets the plastic is more expensive; however, the suggestions below assume only limited numbers of plastic herbarium sheets will be used (for example, one or two sheets per species). In mounting plants on plastic sheets, Archer's plastic was found to be satisfactory.

Botanists sometimes prepare one or two typical "certified" specimens of each species in order to have available identification-aids. These specimens may be kept in a special reference herbarium or in separate folders with conventional herbarium specimens. In either event, if the specimens were mounted on plastic instead of paper sheets, it would be possible to make more effective comparisons with unknown specimens. Even persons with good "form memories" have difficulty comparing details of closely related species without seeing them side-by-side. Fig. 3 shows a more or less typical plant plus selected inflorescences to illustrate much of the variation existing in the species, *Lolium perenne*. Similar plastic sheets of other species of the genus would obviously be very helpful aids to identification in a reference herbarium. In Fig. 4 inflorescences of six of the eight species of *Lolium* occupy one sheet. The information-equivalent of six slides, it compresses much information in a small space.

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